

$$L = n \times p + q$$

where

n is an odd integer  $> 0$

p is the inner length of each chain link,

5  $0 < q < 3.5d$ , and

d is the material thickness of each chain link.

Preferably, the distance  $q = 2.2d$  as shown in figs. 1A and 1B. However, the distance q could be slightly longer, up to  $3d$ , or  
10 shorter than shown down to  $2d$ . With such dimensional limits of the shortening device, it is possible to let the chain links take the full load without transferring any part of the load to the shortening device when the chain is arranged as a straight chain portion along the longitudinal axis D while  
15 still being coupled to the shortening device (as shown in figs. 1A, 1B and 3E. Furthermore, the limit  $q = 2d$  is a necessity for  $n = 1$ . Hereby, it is possible to use the chain to its full strength (although only at full length) without having to detach the shortening device from the chain.

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Figs. 4A and 4B illustrate how the chain shortening device 10 can be used when lifting a box-like object O by means of four chain portions C1, C2, C3 and C4 connected at the top to a master link 50 and at the bottom to four corners of the object  
25 O. Two of the chain portions, C1 and C2, are provided with chain shortening devices. By adjusting the effective lengths of these chain portions, it is possible to balance the orientation of the object, even if the corner points are located differently for different objects, as illustrated in  
30 figs. 4A and 4B. In case, there are only two or three chain

portions connected to a master link 50, it is generally sufficient to adjust the length of only one chain portion, in particular by means of the attachable and detachable chain shortening device according to the invention. It is possible to attach one or more chain shortening devices without detaching the chain portions from the master link or from the load.

A second embodiment of the chain shortening device is shown in figs. 2A and 2B. The elongated body 10' is shorter and has no retainer members. Its length between the opposite seating surfaces A and B is slightly longer to one link ( $n = 1$  in the above formula). Also, the central lead-through opening 20E' is somewhat shorter as compared to figs. 1A and 1B. Otherwise, this embodiment is substantially like the first embodiment.

Of course, it is also possible to have a longer body 10 than the first embodiment of figs. 1A and 1B. This first embodiment is very advantageous in terms of strength, relative low weight and easy manual handling. In this respect, it should be noted that the overall weight and strength is improved by the diverging free end portions as compared to an embodiment as disclosed in the above-mentioned German patent specification (with mutually parallel free end portions of the body).

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A third embodiment of the chain shortening device is shown in figs. 9A and 9B. Here, the elongated lead-through opening 20'''E is provided with a waist portion 22 located in the mid portion of the elongated body 10'''. The waist portion 22 has a reduced width  $w'''$  which is smaller than the outer width  $w$  of the associated chain links. In this way, two apertures 20'''F and 20'''G are formed on each side of the waist portion 22, these two apertures 20'''F, 20'''G communicating with each

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other. Such an embodiment works very well. An end link LO of a loop 41 of a chain can be threaded through the opening 20'''E in upright position. Thereupon, the parallel strands 42, 43 of the loop 41 can be pulled through the respective apertures 20'''F, 20'''G. Because of the shape of the opening 20'''E, the two strands 42, 43 are guided smoothly in the respective aperture 20'''F, 20'''G and prevents the strands from being twisted.

CLAIMS

1. A chain shortening device for shortening an associated chain consisting of oblong links having a material thickness d, an outer width w and an outer length l which is longer than said outer width w, said chain shortening device comprising:
- a unitary elongated body (10) shaped generally like the letter "C" with first and second slot portions (20C,20D) located at the free end portions of the "C",
  - 10 - each of said slot portions including a first and a second pocket-like configuration (20A,20B), respectively, for positioning selected links (L2,L6) of said associated chain in a first and a second coupling position, respectively, and
  - each of said first and second slot portions having,
  - 15 adjacent to said pocket-like configuration, a width which is wider than the material thickness d of said chain links but narrower than the outer width w of said chain links, and adjacent to a mid portion of said elongated body, a widened slot portion defining an aperture, which is wide enough to
  - 20 permit threading said associated chain through said aperture,
  - so that, upon coupling said associated chain to the shortening device with two selected links located in said first and second coupling positions, respectively, the chain links located between the two selected links will form either
  - 25 a straight chain portion, extending at the side of said mid portion of the elongated, generally C-shaped body, or a longer slack chain portion enabling the effective shortening of said associated chain,
  - characterised** in that
  - 30 - said slot portions form parts of a central, single slot (20) extending continuously and longitudinally between said first and second pocket-like configurations (20A,20B), and
  - said central, single slot has a widened mid portion

forming a central lead-through opening (20E), which includes said two apertures and which is dimensioned to permit threading through a loop (41) of said associated chain with two parallel strands (42,43),

5 - whereby the shortening device can be handled as a separate unit and be attached sideways to an existing, associated chain for the purpose of shortening the effective length thereof.

2. A chain shortening device as defined in claim 1, wherein  
10 said central lead-through opening (20E) is elongated in the longitudinal direction (D) of said elongated body (10).

3. A chain shortening device as defined in claim 2, wherein  
15 the width of the slot portions (20C,20D) adjacent to the central lead-through opening (20E) is only slightly wider than said material thickness d of the links of the associated chain, so as to prevent coupling of the shortening device to a chain consisting of links being stronger than those of the associated chain, and the length of central lead-through  
20 opening (20E) is such as to permit threading through a loop (41) of an associated chain with the links of the two parallel strands (42,43) of the loop being positioned next to each other in the longitudinal direction (D) of the elongated body (10).

25 4. A chain shortening device as defined in claim 3, wherein said central lead-through opening (20E) is wider than said outer width w of the links of said associated chain and longer than 1.5 times that width w.

30 5. A chain shortening device as defined in claim 1, wherein said central lead-through opening has, at said mid portion of said elongated body (10), a waist portion with a reduced

width, which is less than the outer width  $w$  of said chain links but greater than the material thickness  $d$  of said chain links, said waist defining said two apertures on opposite sides thereof so as to permit threading through a central portion of an upright link forming the leading end of said loop (41) of said chain through said waist portion and threading through the adjoining parallel strands (42,43) through said two apertures.

6. A chain shortening device as defined in claim 5, wherein each of said apertures are wider than said outer width  $w$  of said chain links but shorter, in the longitudinal direction of said elongated body (19), than said outer width  $w$ .

7. A chain shortening device as defined in any one of the preceding claims, wherein retainer members (30A,30B) are located in each of said first and second slot portions (20C,20D) so as to selectively retain said first and second selected links (L2,L6) adjacent to said first and second coupling positions.

8. A chain shortening device as defined in any one of the preceding claims, wherein said free end portions of said elongated body (10) are directed obliquely away from each other.

9. A chain shortening device as defined in any one of the preceding claims, wherein seating surfaces (A and B), which form parts of said pocket-like configurations and face towards each other, are located at a mutual distance  $L$  from each other, said distance  $L$  being

$$L = n \times p + q$$

where

n is an odd integer  $> 0$

p is the inner length of each chain link of the  
associated chain,

5  $0 < q < 3.5 d$

d is the material thickness of each chain link.

10. A chain shortening device as defined in claim 10, wherein  
 $2d < q < 3d$ .

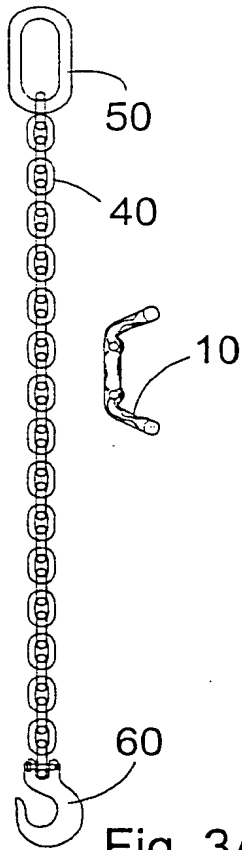


Fig. 3A

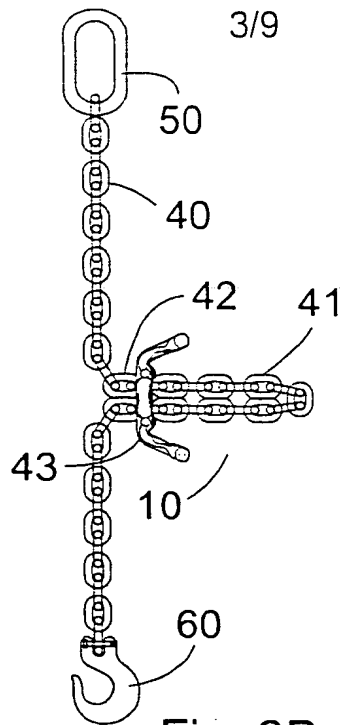


Fig. 3B

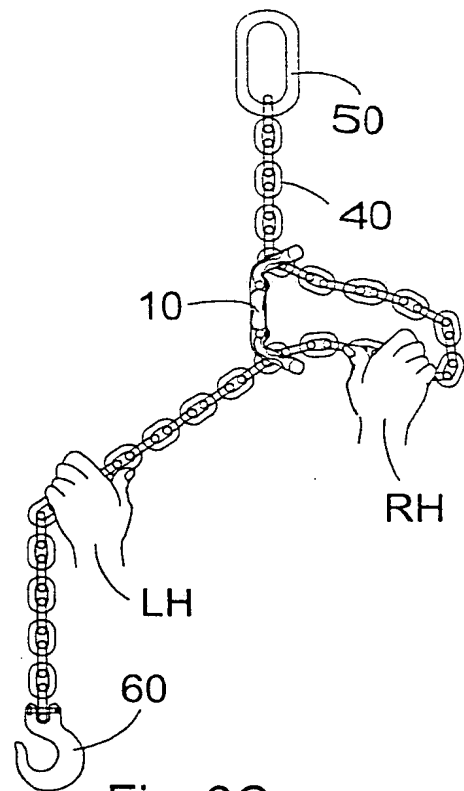


Fig. 3C

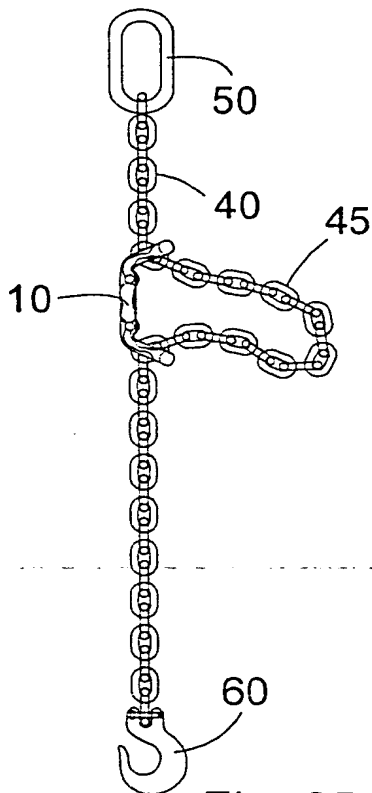


Fig. 3D

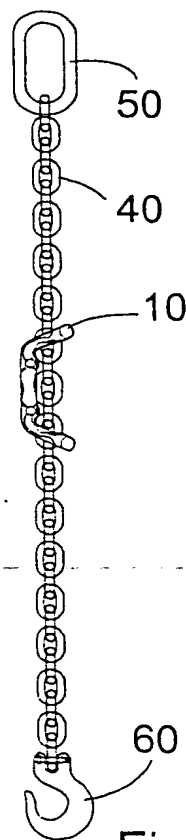


Fig. 3E

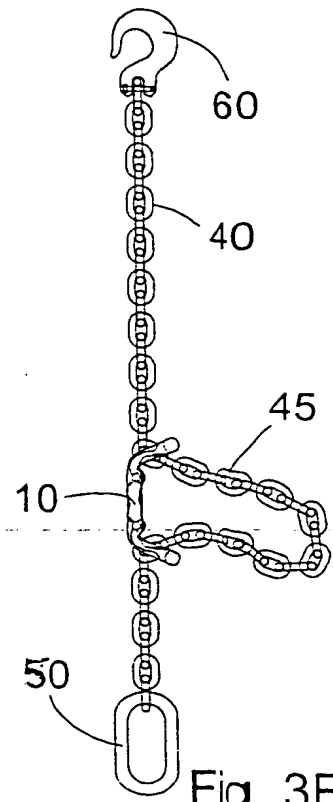


Fig. 3F